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Comments on M.C. Kennedy & A. O'Hagan's 'Bayesian calibration of computer models',
by

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I am a *non-Bayesian* analyst of *stochastic discrete-event simulations*. Such simulations represent 'residual variability' (see §2.1.3, §4.6) through (*pseudo*)*random numbers*. Examples are queueing simulations in logistics, which generate customers' arrival times through a Poisson distribution with a fixed, unknown parameter θ , so waiting times become random outputs.

In such simulations, *calibration* is considered bad practice! For example, observed arrival times should be used to fit an input distribution. Also see the case-study for the Dutch navy in Kleijnen (2000).

I agree that - after estimating the input parameters - uncertainty remains.. But, this uncertainty may be modeled through *Monte Carlo* sampling, using a fitted input distribution; see §2.3. Alternatively, *bootstrapping* may be used; see Kleijnen (2000). Neither approach assumes *normality* for the input or output distributions!

Code uncertainty (§2.1.6) may be caused by programming *bugs*, see verification - not validation - in Kleijnen (2000).

Instead of assuming a *prior* distribution on the linear regression parameters β , we may first estimate β , and then check whether these estimates have signs that agree with experts' prior knowledge. For example, in queueing simulations the estimated main effect of traffic rate θ on waiting time should be positive; else the model violates validation or verification. In a (deterministic) 'global greenhouse' simulation we detected that two computer modules were called in the wrong order.

I think that the *multivariate* character of the code output (§4.1) is relevant: their correlations should be incorporated through generalized least squares. These correlations can be estimated from replicated runs.

Besides *experimental design* for deterministic simulation (§5.1), there are designs (including screening) for stochastic simulation; see Kleijnen (1998).

Observed input data in historical order can validate the total model, so-called *trace-driven* simulation; see Kleijnen et al. (2000).

We should avoid *spurious regressors* (§5.2), in parametric regression too: though they improve the fit, they also deteriorate the predictor. Moreover, besides *prediction* regression serves (parsimonious) *explanation*!

Bayesians and frequentists - and deterministic and stochastic simulationists - should learn from each other: 'East is East, ...' should not apply to the computer simulation area! Fortunately, the authors have succeeded in writing an article that challenges researchers with diverse backgrounds.

References

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173-223